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| --- | --- | --- | --- |
| **Scientist & approximate Date** | **Name of Model, Sketch**  **and main idea of theory** | **Importance and**  **Improvement on previous model** | **Shortcomings - Problems**  **or why was it changed** |
| **Democritus**  **c.300 BC** | Atom the indivisible particle  Atomos (in ancient Greek) means "that which cannot be further broken down into smaller pieces". | * Talks about the atom as the smallest particle of matter. * Defines the atom as an indivisible particle * Explains certain natural occurrences such as the existence of elements | * Does not give a scientific view of the atom only a conceptual definition * Does not talk about subatomic particles   (Electrons, Protons, Neutrons) |
| **Dalton**  **c.1800** | **The solid sphere model**  Atoms are seen as solid, indestructible spheres (like billiard balls) | * Explains a lot of chemical properties such as how atoms combine to form molecules * Explains chemical change better than the [Particle Theory](http://www.clickandlearn.org/Gr9_Sci/Particle_Theory.htm) * Confirms the basic Laws of Chemistry: Conservation of Mass & definite Proportions | * Does not include the existence of the nucleus * Does not explain the existence of ions or isotopes * Does not talk about subatomic particles   (Electrons, Protons, Neutrons) |
| **J.J. Thomson**  **c.1850** | **The raisin bun Model** or the  chocolate chip cookie model :  Atoms are solid spheres made-up of a solid positive mass (or core) with tiny negative particles embedded in the positive core. | * Infers on the existence of electrons and protons * Introduces the concept of the nucleus * Infers on the relative nuclear density and atom mass of different atoms | * Does not explain the existence of electrons outside the nucleus does not explain the role of electrons in bonding * Does not talk about neutrons therefore can't explain radioactivity and the existence of isotopes |
| **Rutherford**  **c. 1905** | * **The Planetary Model** * [Famous Gold Leaf Experiment](http://www.clickandlearn.org/Gr9_Sci/atoms/rutherford.html) proves that the nucleus is positive and the electrons are outside the nucleus. | * Explains why the electron spins around the nucleus * [Proposes that the atom is really mostly empty space](http://www.clickandlearn.org/Gr9_Sci/atoms/rutherford.html#Gold%20Foil%20Experiment:)  * [http://www.clickandlearn.org/Gr9\_Sci/atoms/rutherford.html - Gold%20Foil%20Experiment:](http://www.clickandlearn.org/Gr9_Sci/atoms/rutherford.html#Gold%20Foil%20Experiment:) * [http://www.clickandlearn.org/Gr9\_Sci/atoms/rutherford.html - Gold%20Foil%20Experiment:](http://www.clickandlearn.org/Gr9_Sci/atoms/rutherford.html#Gold%20Foil%20Experiment:) | * Does not place electrons in definite energy levels around the nucleus * Doesn't include neutrons in the nucleus * Does Not relate the valence electrons atomic charge |
| **(Neils Bohr)**  **Bohr- Rutherford**  **c. 1920** | Electrons in **Definite energy Levels** around the nucleus  Used atomic spectra to prove that electrons are placed in definite orbitals (called shells) around the nucleus.    [See Animation Below](http://www.clickandlearn.org/Gr9_Sci/atoms/modelsoftheatom.html#Bohr-Rutherford) | * Explains the role of valence electrons in bonding * Relegates the number of valence electrons to the Periods of a periodic table * Fully explains ionic and covalent bonding * Places electrons in definite energy levels * 2 e- in the first * 8 e- in the second * 8 e- in the third  * [http://www.clickandlearn.org/Gr9\_Sci/atoms/modelsoftheatom.html - Boron\_Model](http://www.clickandlearn.org/Gr9_Sci/atoms/modelsoftheatom.html#Boron_Model) * [http://www.clickandlearn.org/Gr9\_Sci/atoms/modelsoftheatom.html - Boron\_Model](http://www.clickandlearn.org/Gr9_Sci/atoms/modelsoftheatom.html#Boron_Model) | * It does not explain the shapes of molecules or other abnormalities that result form unevenly shared pairs of electrons (such as the abnormal behaviour of water, the difference in Carbon-Carbon Bonds between diamond and graphite etc..) |
| **Modern Theory**  Many Scientists Contributed. Some of the more famous are:   * Schroedinger * Einstein * Louis De Broglie * Max Planck * Frank Hertz * Maxwell * Fermi | [Quantum Mechanical Model](http://www.clickandlearn.org/chemistry/atomic%20theory.htm)  or **Electron Cloud Model**  The analogy here is that of a "beehive" where the bees are the electrons moving around the nucleus in a "cloud" of energy levels. |  | [Advanced Theories will explain bonding and other facts about](http://www.clickandlearn.org/chemistry/atomic%20theory.htm)the behaviour of atoms and their chemical and physical properties in forming new compounds. |